



# The California Hydrogen Highway

May 20, 2004

California Environmental Protection Agency



Air Resources Board



California Hydrogen Highways  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)

# Overview

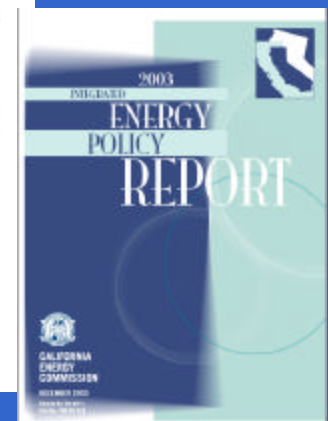
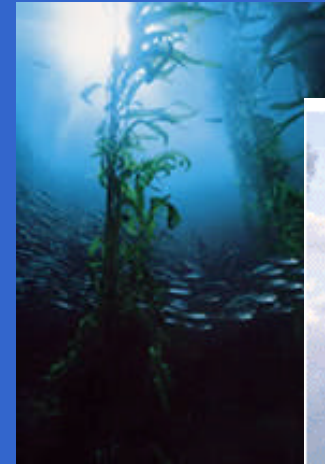
- Why hydrogen and context
- Governor's Hydrogen Economy Blueprint Plan
- Recent announcements
- Conclusion



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

# Why does CA need Hydrogen Highways?

- Environment
  - Cars-- large source of pollution
  - Petroleum dependence-- multi-media pollution impacts
- Health
  - 1.7 million respiratory attacks and 6,500 deaths attributed to air pollution annually in California
- Economy
  - Sustainable fuel supply
- Energy
  - Recent electricity shortages; California must develop renewable, reliable, distributed generation



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

California Hydrogen Highways  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)

# Context

- Near term-- education
  - Driver education
  - Encourage alternatives to single occupancy
- Mid term-- conservation
  - Improved fuel economy
  - Hybrid vehicles
- Long term-- H2 economy
  - Hydrogen highway
- *Focus today -- CA H2 Highway effort*



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

# Current Efforts

- California has continually been on the leading edge of protecting public health & moving towards energy independence
- Environmental
  - ARB's LEV/ZEV regulations
  - ARB's Climate Change regulations
- Energy Independence
  - ARB/CEC 2076 report
  - CEC IEPR



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$



# California Fuel Cell Partnership

- Formed January 1999
- Members include
  - Fuel cell and vehicle manufacturers
  - Energy providers
  - Government agencies



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

California Hydrogen Highways  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)



# California Stationary Fuel Cell Collaborative

- Formed June 2001
- 20 member agencies/organizations
  - State, local, federal, and non-governmental organizations



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

# Hydrogen Highway

- Hydrogen Highway
  - Establish convenient fueling for consumer hydrogen vehicles by 2010
    - Public/private partnership - up to 200 stations
    - Fixed stations + energy stations
    - Portable units



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

California Hydrogen Highways  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)



# Governor Arnold Schwarzenegger's “Hydrogen Highways Plan”

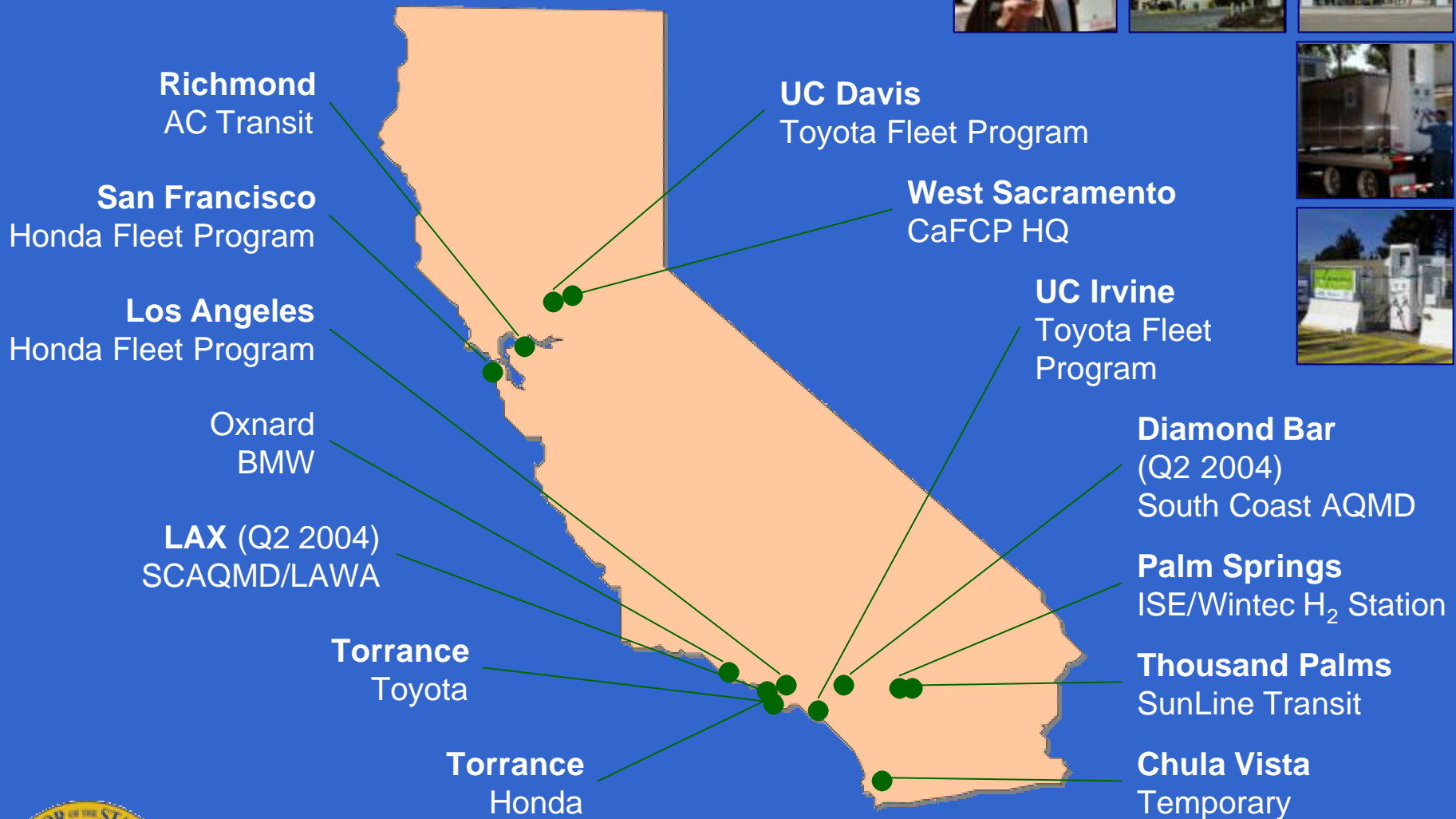
- A baseline network of hydrogen fueling and electrical generating stations along CA's Interstate Highway System by 2010.
- Hydrogen production from renewable resources: farm waste, green waste, solar/waste water projects, existing H<sub>2</sub> capacity.



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

**California Hydrogen Highways**  
www.hydrogenhighway.ca.gov

# Courtesy of the California Fuel Cell Partnership



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

**California Hydrogen Highways**  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)

**Demonstrating H<sub>2</sub> infrastructure**

# California Hydrogen Economy Blue Print Plan

- Cal/EPA shall develop a Hydrogen Economy Plan by January 1, 2005, that will accelerate hydrogen use:
  - Incentive and financing mechanisms
  - Public and private partnerships
  - Promoting environmental and economic benefits
  - Ensuring lowest possible greenhouse and other air pollution emissions



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

**California Hydrogen Highways**  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)

# Executive Level Panel to Direct the Blueprint Effort

- Cal EPA Agency Secretary Tamminen will Chair the Panel
- The Panel will receive input from experts on various specific topics
- The Panel will report to a Senior Review Committee that includes Agency Secretary Tamminen and Legislators



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

# H2 Hwys Implementation Advisory Panel

Air Resources Board  
CA Energy Commission  
CalTrans  
Air Pollution CDs  
Fuel Supplier  
Fuel Supplier  
Utility  
Electric Utility Rep  
US Auto  
Asian Auto  
European Auto  
Academic  
DOE  
Technology  
Enviro  
Enviro  
CaFCP  
CaSFCC  
EJ representative

Alan Lloyd, Chair  
Jim Boyd, Commissioner  
Tony Harris, Acting Director  
Cynthia Verdugo-Peralta, SCAQMD Board  
Don Paul, ChevronTexaco, V.P.  
Jeffrey Lockett, CA Area Mgr, Air Products  
Martha Davis, Inland Empire  
Ed Kjaer, Director, So. CA Edison  
Gerhard Schmidt, V.P., Ford  
Ben Knight, V.P., Honda  
Christoph Huss, Sr. V.P., BMW  
Joan Ogden, UC Davis  
Steve Chalk, Manager, EERE  
Jon Slingerup, President, Stuart Energy  
Jason Mark, UCS  
Roland Hwang, NRDC  
Firoz Rasul, 2004 Chair  
Scott Samuelson, Co-chair  
Luis Arteaga, Exec Dir, Latino Issues Forum



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

California Hydrogen Highways  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)



# Who are our partners?

- Public Sector
  - Sister agencies
  - Regional agencies
  - International agencies
- Fuel suppliers
- Automakers
- Biomass projects
- Big-box retailers: solar panels on flat roofs and hydrogen stations in parking lots



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

California Hydrogen Highways  
[www.hydrogenhighway.ca.gov](http://www.hydrogenhighway.ca.gov)



# How do we pay for it?

- The Partners are contributing most of the cost and human resources
- CalEPA, CARB, CEC and other gov't agencies are providing human resources
- Federal hydrogen funds are needed
- Once commercialized, the marketplace can take over, assisted by revenue bonds



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

# DOE H2 Awards in CA

- H2 fleet and infrastructure demos.
  - 4 of 5 awards involve demonstrations in CA
- H2 storage projects and centers of excellence
  - 6 CA universities
  - 3 CA-based DoE National Labs
  - 3 private sector firms
- FC research - 3 private sector firms
- H2 education development - UC Berkeley



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

# Industry Support

- DCX, Ford, Honda, GM, Toyota, Nissan, Hyundai - DOE grants for demo projects
- BP, ConocoPhillips, Shell, Texaco - DOE grants for demo projects
- BMW - H2 ICE available in 2007



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

# Conclusion

## Near Term Needs - Long Term Vision

- We will not back down on any of our current programs/goals
- We must act today to protect human health and the environment now and in the long term
- Air quality and climate change point to need for H<sub>2</sub> future
- Renewable H<sub>2</sub> desired



$$\left[ \frac{p^2}{2\mu} + V(r) \right] \psi(r) = E \psi(r)$$

